REMARKS/ARGUMENTS

Enclosed herewith is a Petition to Revive an Application Unintentionally Abandoned Under 37 CFR 1.137(b)

The applicant confirms the election of original claims 9 and 10 directed to the invention of Group II. Claims 1 to 8 and 11 to 14 are canceled with the reservation by the applicant of filing one or more divisional applications to the non-elected inventions of Groups I and III.

The description is amended to improve grammatical expression and format according to U.S. patent practice. No new matter is involved.

Claims 9 and 10 are rejected under 35 USC 112, second paragraph. Claims 9 and 10 are rejected under 35 USC 103(a) as being unpatentable over " XP 002085790 or RU 2010672 in view of JP 5-177338 and further in view of Salkeld or Doriath et al."

In regard to the rejection of claims 9 and 10 under 35 USC 112, claim 9 has been amended to overcome the rejection. The text of claim 9 now positively and actively recites the presence of a furnace heater with respect to the mold. The phrase "at a required rate" has been deleted since one skilled in the art is aware of the technical requirements for casting. The radiation in the form of heat comes from the mold in which there is disposed the molten alloy. Claim 9 has been amended to provide antecedent basis for the water-cooled walls.

In regard to the rejection of claims 9 and 10 under 35 USC 103(a), the applicant objects to the form of the rejection. It is not clear what is the prior art basis for the rejection as required by 37 CFR 1.104(c)(2) The Examiner is required to cite in the rejection of any claim only the best references. The present rejection is at best cumulative or duplicative or redundant At least four rejection combinations of the cited prior art appear immediately evident. Is the rejection based on XP '790 in view of JP '338 further in view of Salkeld? Is the rejection based on XP ' 790 in view of JP '338 further in view

of Doriath et al? Is the rejection based on RU '672 in view of JP '338 further in view of Doriath et al? Is the rejection based on XP '790 in view of JP '338 further in view of Doriath et al? Is the rejection based on RU '672 in view of JP '338 further in view of Salkeld? The applicant is not obliged to guess or speculate as to the combination of cited prior art relied upon by the Examiner.

It is noted that the cited XP ' 790 and RU '672 and Doriath et al are cited by the applicant and are indicated in the Information Disclosure Statement and in the description as filed (French Patent Application No. 26043378, cited on page 2, line 5, corresponds to Doriath et al). JP '338 and Salkeld are newly cited (with the understanding that the cited Salkeld refers to US 4,108,236 and not US 4,412,577 cited in the Information Disclosure Statement). It is also to be noted that the teachings of XP '790 and RU '672 are not the same as the former is an abstract of the patent while the latter is the full text of the patent.

The Examiner's observation of the teaching of XP '790 is not disclosed in the abstract cited as the prior art. The Examiner's observation of the teaching of RU '672 is disclosed in the description and drawing of the patent cited as the prior art. The abstract fails to disclose metal casting production other than single crystal from a seed and the abstract fails to fails to teach the presence of means for cooling.

RU '672 teaches a liquid metal cooling bath 3 as a cooling zone for the mold and molten metal casting. The bath is formed by a container having a substantially uniform cross-section with an open top portion and a closed bottom portion. The open top portion has a circumferential flange that is adjacent to but separated by a gap H from the heater 2. There is no disclosure in RU '672 of a means for cooling other than a liquid metal bath, i.e., cooling by submerging the mold and the molten metal casting.

The Examiner acknowledges that XP '790 and RU '672 each fail to disclose the removal of heat by radiation cooling. At best XP '790 and RU 672 teach conduction cooling by submersion.

The Examiner alleges that JP '338 teaches "radiation *cooling* for the purpose of effectively directionally solidifying the molten alloy without drawing crack in the mold 1" (emphasis added). The applicant disagrees with this allegation as it appears to be contrary to the teaching of JP '338. In JP '338 the reflecting concave mirrors do not cool but instead provide *heat* to the throat 7 of the mold.

Accordingly, the rejection of claim 9 as filed and as amended has no basis in XP '790 or RU '672 in view of JP '338.

The Examiner acknowledges that neither XP '790 nor RU '672 teaches water cooling. The Examiner alleges that Salkeld or Doriath et al. teach water-cooled means for the tank (presumably cooler 3 of RU '672). The applicant disagrees with this allegation. The cooling coils 26, together with the heating elements 24, of Salkeld are for the purpose of controlling the temperature of the liquid cooling provide by the bath 20 and liquid 22. This function is distinct and separate from the function of the chill plate 4. The cooling in Salkeld is not by radiation cooling as recited in claim 9 as filed and as amended but by conduction or convection cooling. Similarly, in Doriath et al the function of the cooler 24 is distinct from the function of the chill plate formed by plate 62.

In a rejection under 35 USC 103(a), the Examiner must establish in the cited prior art not only the structural or steps of the features of the claims but equally important a rationale or motivation as taught by the prior art for the combination of the prior art. It is submitted that the Examiner has not satisfied this criteria and has failed to establish a prima facie rejection of obviousness. The Examiner has not cited any basis in the cited prior art for the rationale or motivation for one skilled in the art to combine the cited prior art in the

manner alleged. To the contrary, the cited prior art does not have the structure or the steps recited in claim 9 as filed or as amended and do not have the function of the steps recited in claim 9 as filed or as amended.

Claim 9 has been amended to recite among other features, that the cooling zone comprises a tank having an open upper portion and a closed lower portion with water-cooled walls extending therebetween, the open upper portion being immediately adjacent to the heating zone and the solidification of the molten alloy is by radiation cooling onto the water-cooled walls of the tank. The combination of these features is not disclosed in the cited prior art.

Accordingly, the rejection under 35 USC 103(a) of claim 9 as filed and as amended has no basis in XP '790 or RU '672 in view of JP '338 or further in view of Salkeld or Doriath et al.

Claim 10, dependent on claim 9, is considered allowable for the same reasons as claim 9

New claims 15 to 25 are submitted herewith and are considered novel and non-obvious for the same reasons as claims 9 and 10. In particular, claims 15 and 24 recite the shape of the tank that is not disclosed in the cited prior art.

Applicant respectfully requests that a timely Notice of Allowance be issued for this application.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE DESCRIPTION:

Paragraph beginning at page 2, line 4, has been amended as follows.

-- The closest prior art to the embodiments of the present invention is an apparatus disclosed in French Patent Application 2604378 [, being accepted as a prototype]. [This prototype] French Patent Application 2604378 discloses an apparatus [comprises] comprising a vacuum chamber with a heating member inside where there is disposed a ceramic mold fixed on a water-cooled metallic plate which is moved up and down with the help of a rod and of an actuator for vertical transportation. A horizontal baffle separates a heating zone and a cooling zone. In the cooling zone, concentrically with the chill plate, there is disposed an additional circular water-cooled cavity with the inner diameter exceeding the mold's maximal size. Below the cavity there is disposed a container that is utilized for capturing the poured casting metal in the event of mold breakage. --

Paragraph beginning at page 2, line16, has been amended as follows:

-- The above apparatuses, including the [prototype] apparatus of French Patent Application 2604378, can function only when they comprise a crystallizer. It is impossible to use such installation for directional solidification processing with a liquid metal coolant and it is difficult to utilize the expensive alloys used in directional solidification castings in the event of mold breakage. Thus there is a need for a casting apparatus that provides a means that efficiently cools the molten cast alloy while protecting the equipment from damage in the event that the ceramic mold breaks while containing the molten cast alloy material. --

Paragraph beginning at page 3, line 3, has been amended as follows

-- An embodiment of the [To achieve said aim the inventive] apparatus comprises a vacuum chamber inside which there is disposed an induction melting furnace, a mold preheating furnace with a ceramic mold, a drive assembly for mold transportation and a water-cooled tank. The drive assembly comprises a rod on which the mold is fixed with the help of a hanger and a regulating actuator for vertical movement being positioned above the vacuum chamber. The water-cooled tank is shaped as a truncated cone. The tank [Its] upper portion is opened towards the heating zone, and its bottom portion has a smaller base than the upper portion. A baffle separates the heating zone inside the induction furnace from the cooling zone. [;said] The baffle moves in a horizontal plane and closely adjoins the mold during the solidification process. The [It] baffle consists of the segments or sectors (not less than 2 from each side). –

Paragraph beginning at page 3, line 17 has been amended as follows:

-- Figs. 1 and 2 show a schematic drawing of the apparatus where 1 [I] is a [the] ceramic mold, 2 is a [the] hanger to fix the mold to a [the] drive assembly, 3 is a [the] rod, 4 is a [the] heater of a [the] mold preheating furnace, 5 is a [the] heat baffle, 6 is a [the] water cooled tank, 7 is a [the] molten superalloy, and 8 is a [the] starting zone with a seed.--

Paragraph beginning at page 4, line 21, has been amended as follows:

-- In another aspect of this invention, in order to produce blades having single crystal structure with desired orientation, a single crystal seed with proper orientation is positioned into the top of the starting zone (8) of the

ceramic mold before it is disposed in the vacuum chamber. Then the mold position is strictly fixed relative to the heater. In such event the seed and the solidified portion of the starting zone serve as a cooling medium, and further solidification of the melt is caused by radiation cooling in the water-cooled tank as stated above. The use of the water-cooled tank instead of a chill plate allows the same or better working efficiency of the tank than that of a chill plate or of the [prototype] circular water-cooled cavity. At the same time the water-cooled tank of this embodiment of the invention does not require the use of a complex drive assembly with airtight seals. --

Paragraph beginning at page 5, line 13, has been amended as follows:

-- The embodiments of the apparatus and method of this invention allows one to produce high quality castings having the directional and single crystal structure, including the large sized castings used, for example, in the land based turbine industry, by the method of radiation cooling without using the crystallizers of the prior art. The embodiments of the invention also gives the possibility to reconstruct easily the disclosed apparatus for liquid metal cooling crystallization processing, to use successively the [invented] water-cooled tank as a mold catch basin in the event of mold breakage, and to increase the reliability and economic profitability of the apparatus performance. --

IN THE CLAIMS

Claims 1 to 8 and 10 to 14 are canceled.

Claim 9 has been amended as follows:

9 (amended) A method of making a [directional or single crystal] metal casting comprising the steps of:

a. placing a mold in a mold [preheating] furnace [relative to] having a heater;

b. heating the mold to a temperature of about 100 to 150 ^{0}C above a [the] liquidus temperature of a casting alloy;

c. pouring a [the] molten casing alloy into the heated mold;

d. lowering the mold with the molten alloy [at a required rate] into a cooling zone comprising a [water-cooled] tank having an open upper portion and a closed bottom portion with water-cooled walls extending therebetween, the open upper portion being immediately adjacent to the heating zone; and

e. solidifying the molten alloy by radiation cooling onto the water-cooled wall of the tank to form the metal casting.